Pleasant Hills, PA. sewage treatment plant project utilization of biogas produced in an anaerobic digester

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Project Overview

The Pleasant Hills Sewage Treatment Plant (PHSTP), Pleasant Hill PA, located adjacent to the National Energy Technology Laboratory's, (NETL) Pittsburgh site was chosen as a demo site for several reasons. The sewage treatment facility continuously generates a significant volume of "biogas," a foul-smelling, corrosive mixture of methane, carbon dioxide, and hydrogen sulfide as part of their anaerobic waste treatment process. Although the biogas has a substantial higher heating value (600 Btu/CF), the plant currently flares the biogas because of its corrosive effect on equipment. Additionally methane and carbon dioxide are both greenhouse gas and the reduction of these emissions was considered a prime driver. Gas clean up/quality upgrade and energy utilization technologies options were to be developed.

Partnership development

Late in 1999, partners form the energy industry, state and local government were engaged to develop this biogas as an energy resource. NETL's Institutional Plan states NETL shall "become a more valued community regional asset" and encourages its employees to "seek opportunities to address mission related regional issues". A multidisciplinary partnership was coordinated by NETL: Pleasant Hills Authority (PHA), Pennsylvania Department of Environmental Protection (PaDEP), Business Development Group, Gannett Fleming, Inc., Advanced Technology Systems (ATS), Inc., Carnegie Mellon University (CMU), Allegheny Power, Equitable Gas and Columbia Gas of Pennsylvania

This Project combined the expertise of NETL and the partners to evaluate technology options to harness the energy resource that was being wasted, while simultaneously reducing harmful environmental emissions. This concept, which has the potential for nationwide application, was endorsed by NETL's Regional Development Program, and championed by several NETL's Associate Directors. The balance of 1999 and part of 2000 was spent organizing the partnership of regional entities and having the project reviewed by internal and external stakeholders. Project Plans were developed with the cooperation of this diverse group of partners.

Summary of biogas utilization feasibility study

The feasibility study, which was conducted by NETL personnel with the oversight of the regional partnership, included the following elements.

- ?? Plant Characterization: The team characterized PHSTP's operating procedures, including a detailed analysis of their electricity and natural gas usage.
- ?? Design Requirements: The team determined the basic design requirements for a biogas utilization project at PHSTP, including space availability, location, electrical interface, thermal interface and gas cleanup requirements.
- ?? Technology Survey: Three technologies were surveyed for their applicability to the PHSTP project: fuel cells, reciprocating engines and microturbines.
- ?? Life Cycle Cost Analysis: Four different biogas utilization project options were modeled to determine their technical and economic performance. A life cycle cost analysis (including a sensitivity analysis of essential variables) determined each option's net present value.

?? Environmental Analysis: The potential impact on greenhouse gas and criteria pollutant emissions was determined for each of the four-biogas utilization scenarios. An environmental valuation was performed to provide an economic metric to determine environmental benefit of each option.

Project outcome

During 2000, the project team, under the oversight of the regional partnership, completed the detailed study that determined the technical and economic feasibility of several biogas project options at PHSTP, including a 30-kilowatt microturbine cogeneration system. In October 2000, NETL presented the results of this study to the Pleasant Hills Authority, which oversees PHSTP. Consequently, the Authority decided to install the microturbine cogeneration system and authorized their engineering firm, Gannett Fleming, to proceed with the detailed design. Although NETL hopes to have an R&D role (e.g., gas cleanup & carbon dioxide sequestration) once the project is installed, NETL's regional project development goals were successfully achieved with the Authority's decision to proceed with the project. Besides reducing their contribution to global warming and serving as a prototype for other plants they could reap the potential Net Present Value (NPV) of $86,000, $36,000/year in criteria pollutant credits, as well as the potential benefit of $36,000/year in greenhouse abatement credits, if a gas trading or credit program were to exist .

***Promoted regional & global environmental benefits*:** NETL addressed both criteria pollutant and greenhouse gas emissions from PHSTP and the biogas utilization alternatives. Criteria pollutants are the primary ingredients of smog, a local pollution problem, and greenhouse gases are the main cause of global warming, a global pollution problem. NETL's initial analysis of emissions impact determined that PHSTP could reduce greenhouse gas emissions by 78,000 metric tons of carbon equivalent (MMTCE) per year and criteria pollutant emissions by 2070 tones/year after installing a biogas microturbine system, thus promoting local action on regional and global environmental quality.

***Transferred technology for project replication*:** The feasibility study was documented in a 40-page report to transfer results to interested stakeholders in the sewage treatment, distributed generation, and environmental (including climate change) communities. It is hoped that papers based on this report will motivate hundreds of plants similar to PHSTP to seriously consider a biogas utilization project. Furthermore, the analytical model that was developed for this project could be used again to evaluate similar projects.